ORBIT 5

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WE WISH OUR READERS
A MERRY CHRISTMAS
AND
A HAPPY NEW YEAR

Vol. 1, No. 5/December 1970
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for Studies in Education

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Microteaching and Minicourses — H. Oliver, OISE — 3
Notes on Teacher Education — 6
A Centre for Science Education — A. L. Mansell, University of London — 10
Lakehead District R.C.S.S. Board Seminar Program — 12
Child — John McInnes, OISE — 14
Kids Deserve a Natural Hi — R. G. Des Dixon, OTF — 16
The Perception Bag — C. Kenneth Johnstone, Cambridge University — 19
Experimenting with Communications — Robert Kerr and Wilma Bagg, Ridgeway Senior School — 22
Practice through Inquiry in Mathematics Learning — Shmuel Avital, Israel Institute of Technology — 24
Au-Dessus du Nationalisme — Gérard Gilbert et Dormer Ellis, OISE — 26
Teaching Aids from the Community—Bell Canada — 27
Profile of a School 7/University Elementary School, UCLA — 28

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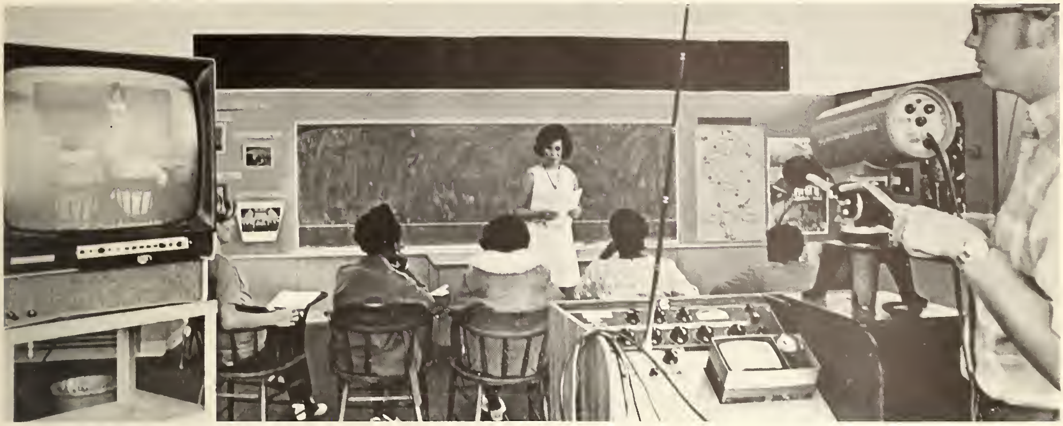
MICROTEACHING AND MINICOURSES



A method of teacher training

Hugh Oliver/OISE

Based on the *Stanford Center for Research and Development in Teaching Report 8*, by Dr. David C. Berliner, and on information supplied by the Far West Laboratory for Educational Research and Development

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A student teacher watches a videotaped model lesson accentuating a particular teaching skill — for example, asking probing questions that require a pupil to go beyond his initial response. With the student teacher is a supervisor who helps him to pinpoint examples of this skill in the model lesson. The student teacher then prepares a lesson of his own — usually about five minutes long and designed to emphasize the skill he has been studying. He gives the lesson to four or five pupils; meanwhile he is being videotaped. In company with his supervisor, he critically examines his own videotaped lesson, then replans the lesson and teaches it to a new group, again being videotaped. This sequence, which in essence is microteaching, may be repeated several times until he has mastered the skill.

Microteaching was first developed in the Stanford Teacher Education Program at Stanford University in California, and was expanded and refined by the Stanford Center for Research and Development in Teaching, beginning in September 1965. It represents the marriage of two techniques: that of videotaping, which allows us 'To see oursels as others see us'; and that of breaking the 'art' of teaching into a number of clearly defined skills that can be learned and evaluated. It is a technique that affords much more control over the training process than traditional observation of classes. It also focuses on specifics and not on generalities.

Unlike the brainchildren of many educational researchers, microteaching has been adopted comparatively quickly. Since F. J. McDonald, D. W. Allen, and R. N. Bush began working on the technique in 1963, it has come to be used in a large number of teacher-training institutions — in Canada as well as the United States. The General Learning Corporation (3 East 54th Street, New York, N.Y. 10022) is distributing a multimedia teacher-training package making use of the Stanford techniques and, as outlined later in this article, the Far West Laboratory for Educational Research and Development is developing Minicourses based on the use of microteaching for the inservice training of teachers.

TEACHING SKILLS

Whereas teacher training has generally been competent in the handling of subject disciplines, the 'art' of teaching has tended to be neglected in the belief that it is unteachable; it is an old saw that good teachers are born not made. By concentrating on specific teaching skills, microteaching has done much to change this attitude. Following are some of the skills that research workers at Stanford have been exploring:

Higher order questioning

This is the type of questioning that encourages pupils to use ideas rather than remember them. For example, 'How many people were in the room?' calls for an answer available from memory. 'How many people are in the room?' calls for an answer available from direct observation. But 'Can you infer something about the relationship of the people in the room?' demands more cognitive effort, and is an example of higher order questioning. Research has shown that a written model lesson is often as effective as a videotaped model in developing this skill.

Reinforcement

The ability to reinforce participation may be classified into positive verbal reinforcement, where the teacher uses such words as 'good,' 'fine,' 'nice job,' immediately following an acceptable response from a pupil; positive non-verbal reinforcement, where the teacher nods his head, smiles, or writes the pupil's response on the blackboard; positive qualified reinforcement, where, though the response is unacceptable, the teacher reinforces participation by such remarks as 'That's good, but . . .' or 'Right, but don't forget . . .'; and positive post hoc reinforcement, where the teacher recalls a previous positive contribution by the pupil or asks him to repeat a point he has made. These four classifications have their negative counterparts, showing how certain teacher responses could punish participatory behavior.

Probing
As mentioned before, this is a questioning technique that requires pupils to go beyond the response they first made. Socrates was the acknowledged master of this skill. Probing techniques include seeking clarification — 'What do you mean?,' 'Would you rephrase?'; increasing critical awareness — 'What are you asking here?,' 'Justify your answer rationally!'; refocusing — rather than probing deeper, the teacher calls attention to related areas of knowledge through such questions as 'What are the implications of this for . . .?' or 'How does that relate to . . .?'; prompting — the teacher does not accept 'I don't know' but encourages the pupil by referring him back to material he does know; redirection — the teacher asks pupils other than the one who made the original response if they can add to the answer.

Varying the stimulus situation
Techniques that some teachers use — either deliberately or intuitively — to hold the attention of a class include moving around the classroom (though not continual movement which may be distracting); employing expressive hand, head, and body gestures to reinforce spoken communication; using such words as '*Look* at this diagram,' or '*Listen* closely,' or alternatively using focusing gestures to direct attention; varying interaction styles from lecturing to questioning and from interchange with a single pupil to general discussion; and shifting sensory channels from the oral to the visual or, where possible, to the tactile.

Silence and nonverbal communication
The 'deafening sound of silence' can be an effective attention getter but it is one that most teachers stay away from. Nonverbal communication embraces the use of such gestures as a raised eyebrow, a frown, a cocked head, a nod, or a smile. Sometimes a teacher's nonverbal gesture may contradict what he is saying; microteaching helps to make the teacher more sensitive in this area.

The control of small group discussions
Different styles of leadership in small groups produce different effects leading, say, to a teacher-centered discussion or a pupil-centered discussion. By using certain techniques, the teacher can channel the discussion along the lines he wishes.

The skills listed above represent some of a number of skills that have been investigated in microteaching situations at the Stanford Center, and results show that microteaching enables student teachers to obtain some mastery over them. The research workers, however, are quick to point out that their studies are very far from complete. For example, the impact of these skills on pupils' behavior has yet to be carefully assessed. New skills must be identified and integrated into overall teaching strategies. Indeed, the microteaching situation itself requires more investigation — the ideal number of pupils and the ideal length of lesson are but two of many questions that need further empirical study.

At present, researchers at Stanford are concentrating on such areas as assessing the teacher's capacity to listen to and make use of pupils' ideas in classroom discussion, exploring ways in which teachers can overcome the stress reaction generated by the classroom setup, and studying the beginning teacher's ability to ask analytic questions. Recent work has shown that aptitudes interact with skill-training methods, suggesting that different types of training may be needed for teachers with different aptitudes.

Richard E. Snow, Coordinator of the Center's Heuristic Teaching Program, sees teaching as 'a complex information processing activity, perhaps better described as an orchestration of skills. Through research efforts, a number of new skills may be defined and added to the list already available from earlier work. Increasingly, however, these skills will be conceived as organized in ordered sequences of complementary skills. Microteaching training would then consist not of a collection of unrelated skill acquisition experiences offered in more or less random order but rather of a systematically arranged program where individual skills might be practiced both separately and in exercises designed specifically for particular combinations of complementary skills. In other words, training may start with isolated elemental skills, but it must also "put the teacher back together again." ' (From 'A Second Generation of Microteaching Skills Research,' a paper presented by Richard E. Snow at the 1969 annual meeting of the American Psychological Association, Washington, D.C.)

MINICOURSES
Working in close collaboration with the Stanford Center, the Far West Laboratory in Berkeley is developing Minicourses that make use of microteaching techniques primarily for the inservice training of teachers. The Minicourse model differs from the Stanford model in two major respects. It comes as a self-contained package of inservice training materials that can be used in any school where a videotape recording system is available. And, unlike the Stanford model, which employs feedback from trained supervisors, it provides feedback through self-evaluation and peer interaction, relying heavily upon films of model lessons by master teachers.

In operation, however, the Minicourse closely resembles the microteaching procedure described at the beginning. In each instructional sequence, the teacher first views video films that demonstrate specific teaching techniques, then tests his recognition. Afterwards he prepares a brief lesson for a small group of pupils that will enable him to practice one or more of these skills. Simultaneously, he records the lesson on videotape. Later he replays and analyzes his performance, using the self-evaluation forms provided in the teachers handbook. He then refines the techniques he has learned by replanning the lesson, presenting it to a second small group of pupils, and evaluating himself once more. He may review the playbacks with another teacher who is taking the course, but only if he wishes to do so.

The Minicourse offers several advantages for inservice training. Because the teacher is working with a short lesson and only a few students, he is encouraged to try out new methods. He also learns specific teaching skills through direct experience, which is generally far more effective than trying to learn them from books or lectures. Finally, the videotape provides him with immediate feedback and enables him to evaluate his progress and reinforce what he has learned.

At present, the Laboratory has one Minicourse on the market, dealing with twelve specific questioning skills that the teacher employs in class discussion. The package consists of eleven reels of instructional and model lessons on 16 mm. color sound films; a coordinators handbook, with follow-up lessons; a teachers handbook, including self-evaluation forms; a brief information handbook called *The Minicourse in Your School;* and *The Minicourse: A Microteaching Approach to Teacher Education,* a presentation of the research and testing results of the Far West Laboratory's massive R and D program that takes each Minicourse through a twenty-seven-step cycle of development and field testing before it is put on the market. To complete the first Minicourse requires about three hours a week for five weeks. Cost of the complete course package is $1,425 U.S. It can be used by any number of teachers since the only expendable item is the teachers handbook ($1.80).

Four other Minicourses have been completed and will shortly be on the market: Minicourse 2 — 'Thought and Language: Skills for Teaching the Child with Minimal Language Development'; Minicourse 3 — 'Effective Questioning in High School Class Discussion'; Minicourse 5 — 'Individualizing Instruction in Mathematics'; and Minicourse 8 — 'Organizing the Primary Classroom for Independent Learning.'

A statement of the objectives and behavioral specifications required for each lesson is provided to the teacher, as exemplified by the following extract from Minicourse 3:

Practice Lesson
Objectives:
To acquire familiarity with minicourse procedures. To distribute participation evenly.
Specific Behavior:
Call on nonvolunteers as well as volunteers.

Lesson One
Objectives:
To reduce teacher actions that interfere with class discussion.
Specific Behavior:
Repeating own questions.
Answering own questions.
Repeating student questions.

Lesson Two
Objectives:
To probe for more thoughtful responses from students.
Specific Behavior:
Prompting.
Seeking further clarification.

Lessons Three, Four, and Five
Objectives:
To increase teachers' use of higher cognitive questions.
Specific Behavior:
Frame comprehension, analysis, and evaluation questions. Use prompting, further clarification, and redirection.

Some of the data obtained from field studies in which Minicourse 1 materials were used are shown in the table below. The results show not only a marked improvement after study of the Minicourse, but also a consistent long-term effect.

The Laboratory also has a dozen other Minicourses in the development mill and, projecting forward, has plans for producing about fifty. Although many of these courses will continue to deal with basic behavioral skills, testing is underway to extend the teacher's skills into other areas. For example, Minicourse 2 is designed to improve the kindergarten teacher's skill in helping culturally deprived children with their language difficulties; this, it is hoped, will be the forerunner of Minicourses on skills needed to reach nontypical pupil groups. Another series of Minicourses will deal with skills needed to work effectively in such new educational settings as individualized instruction and team teaching. Finally, it is hoped to produce Minicourses that will provide inservice training in the skills necessary to teach new curriculum programs.

Behavior	Mean Score Before Minicourse	Mean Score Immediately After Minicourse	Mean Score Four Months After Minicourse
Proportion of teacher talk	53.18	29.44	30.44
Proportion of higher order questions	26.16	52.27	48.58
Length of pupil responses (number of words)	5.70	11.55	12.46
Number of redirection questions	24.71	39.18	36.94

For information about Minicourses, write to:
The Education Manager
Collier-Macmillan Canada Ltd.
1125B Leslie St.
Don Mills
Ontario

NOTES ON TEACHER EDUCATION

From a conference entitled 'Teacher Education — A Search for New Relationships,' sponsored by the Development Advisory Committee of the Ontario Institute for Studies in Education and held at the Constellation Hotel, Toronto, April 16-18, 1970. Copies of the conference proceedings are in preparation and will be available from Publications Sales, The Ontario Institute for Studies in Education, 252 Bloor Street West, Toronto 181, Ontario.

Cartoons by Pavel Rak

I desire that all teachers have a broad general education and I want them to have special confidence in one or two subject areas: this they should gain — at least in part — in their first degree program. But when it comes to professional education, it is essential that the teacher be able to deal with problems that require him to draw on all his background regardless of the subject area. . . .

Many of us have visited classrooms in other jurisdictions and countries. Can any of us honestly say that we would trade our province's educational system as a totality (if I may use that term) for the total educational system anywhere else? As far as I am concerned, the answer is a categorical no. If you agree with me, we must give some credit to our teachers and to the system of teacher education which they experienced or are experiencing. Are there any of you in this room, for example, who attended a normal school or a teachers' college in this province and are prepared to admit that you are, or were, a poor teacher? If not, I believe that some credit must be given to the program of teacher education that you enjoyed — or, as many are inclined to describe it, endured. . . .

We have often heard the establishment of ungraded classes in elementary and secondary schools described as an improvement in education and, indeed, the public has all too often accepted it as such. But without the corresponding acceptance and implementation of a philosophy that recognizes the differences in children — in the way they grow and develop, in the way they learn, and in the rate at which they learn — the organizational change is meaningless. All it can do is facilitate the attainment of certain goals. Analogous circumstances will apply in the transfer of teacher education to the universities. I am excited about the possibilities of this transfer, and I see evidence already of the development of programs of a positive nature; but, as in any new enterprise, there are certain dangers and risks that must be recognized. . . .

A faculty of education's best chance for survival in the academic jungle is to recognize the unique job that it has to do and to strike out boldly without attempting to emulate other patterns serving different purposes. Such a policy will require the development of new relationships within the academic community; but for the professional education faculty, these relationships will be based on independence of thought and action and on self-respect rather than on subservience to traditional patterns that are inapplicable to professional education and that give evidence of less and less relevance to the areas in which they have been traditionally applied.
J. R. McCarthy
Deputy Minister of Education
Province of Ontario

Except that the history of education has been dropped, the titles of the courses have hardly changed at all. Even in faculties of education the same courses are still there, usually broken up into bits and pieces to make the programs look more like those of a university.

As for the teaching-learning modes in the various courses, there seem to have been few, if any, changes . . . In most courses, the incomprehensibilities, boredoms, and irrelevancies of the talk-listen teaching mode are still there. The only change seems to be in the forms of the coercions. . . .

What I have briefly said marks the slow pace of teacher education in Canada since 1847. Some people might say: 'But look how long it has taken everything else to come alive! What do you want in teacher education? A miracle?' Considering the acceleration of change in the world around us these last hundred years, perhaps that is what teacher education really needs — a miracle.
Wilfred Wees
OISE

I believe that what we are doing is mostly educating people for unreality. Unreality seems to me to include, among other things, the stereotypes of people. When you look at the stereotypes, you don't actually see the people. You have ideas about what they must be like and so you fit them into those ideas. In moral behavior, unreality seems to be thinking that there are certain fixed rules by which we can organize our lives. Closer to reality is the recognition of 'situational ethics' — the situation is always caused by the people, and it is by the acknowledgement of the people with whom one shares the situation that one's ethical decisions are made. . . .

I think that in an era of the kind of uncertainties we face, we have to realize that the concept of an adult who 'knows it all' is really something in the past. I think we are the first generation that cannot sit there saying: 'Right! We know it.' In the past, the young might object, protest, and sow wild oats, but they knew that sometime they were going to reach the stage of certainty. It is not like that any more. And this is what makes the situation for the teacher so complicated, even for the teacher who has not had this education in unreality. . . .

Another thing that I think we are doing in education is separating feeling from thinking and denigrating feeling. We think that the arts have something to do with feeling and are therefore something quite separate. We do not engage in the arts as a form of deepening our experience as well as expressing that experience. We teach science, not as real science, but as dogma. . . .

Above all, the thing that we learn is to work very experientially as we would work with children: we are involved in junior science (a very open kind of science); we do a lot of acting together; we go and see schools together; we go and talk with children (disturbed children perhaps); we work with each other making things. There is always a very strong artistic component in what we do. Especially, we learn the most important thing for experienced teachers — we learn to waste time together, and we learn that wasted time is not wasted. . . .

For a short cut I might say: 'I am a teacher.' But I do not think of myself as just a teacher. I am just me and you are just you. One of the dangers of teaching is that you tend to dissolve into your role. You very often leave the real part of yourself at home and bring certain bits to school — the historian bit, the biologist bit, the reading-teacher bit — and all that other part of yourself, your own useful self that children so much need to know, is left at home.
Charity James
Goldsmith's College
University of London

I think the best teachers are those whose personalities allow them to become involved with students and who show themselves to be sincerely interested.
High school student

Control and discipline remain of paramount importance.
School principal

Every teacher is different. There are authoritarians and one can learn from them. Others are better at interaction. Why not recognize the differences and capitalize on them?
High school student

I have had it right up to the eyeballs with the so-called open systems. Time and time again I have seen completely unproductive classroom situations where the students are allowed to tell the teacher what they wish to do.
Supervisor

A teacher teaches when he looks at you and sees you as 'you' — sees you as a person. When that happens to me, I learn.
High school student

Academic qualifications are important, but not necessarily the most important.
School principal

There are some basic differences between a teacher of mathematics who is teaching students to become teachers, and a teacher of mathematics who is teaching students to become mathematicians.
Staff member of a teachers' college

As long as the schools continue to serve as social selection agencies, and teachers and pupils have to relate in a vast bureaucracy, the sort of relationships that Charity James asserted were desirable — and with which we so quickly and easily agreed — are going to be extremely difficult to attain.
Recorder of a conference discussion group

As a result of this lack of a theoretical position, I got the impression that teacher training has no idea what it is doing or why it is doing it. The real questions fairly clearly are: What is a good teacher? What qualities does he have which we can identify? Can we teach those qualities and, if so, what is the best way? These questions were raised and almost immediately dismissed as unanswerable or answered in a self-evident way. Any suggestion that one might approach the issue armed with some tools of research was just not in evidence.
Recorder of a conference discussion group

Teaching teachers is different to teaching content to other students in that the transition from student to teacher is quite complex. It's a problem that, in many cases, other faculty members of the university don't have to face. I think that, obviously, we haven't worked it out. Certainly it hasn't been worked out in the present teachers' colleges. I wouldn't think that we should assume that we have the answers there. I don't think it has been worked out too well in the universities that provide teacher education programs, but I think there are some ways of providing opportunities for this transition to happen and these should be better opportunities than the ones we have had.
Staff member of a teachers' college

A teacher ought to be able to relate his subject to his students in such a way that they can connect with it. Teachers are the determiners of whether kids like a particular subject.
High school student

A teacher ought to be stimulating, someone capable of creating an inquiry environment.
Staff member of a teachers' college

Perhaps the selection of teachers ought to begin away back in high school. In some schools, as far back as forty years ago, teachers were identifying and encouraging teacher prospects by giving students an opportunity to teach their classmates. Here's where we ought to begin — in a cooperative way with practicing professionals in the schools.
Staff member of a teachers' college

I regret that there's nothing definite by way of teaching competency like a doctor's skill in performing a tonsillectomy.
School superintendent

Many of the student teachers are convinced that following their year at teachers' college they are already competent.
Student teacher

Upping the academic standard may be quite irrelevant. I would just ask one thing: that the candidate be a good learner himself. How well can he listen? Has he a capacity for a continuous relationship with the environment? Has he a considerable degree of flexibility? I am advocating a policy of self-selection; I would allow students themselves to decide if they were adequate teachers.

Last fall in the Parkway Program we created a learning community of 275 persons, consisting of 100 elementary school and 100 secondary school pupils, graduate students, and staff. In this learning community we institutionalized the practice of students assisting each other. It was truly extraordinary how many found that they could teach. If you would start with these communities, you would learn two things: that teaching is normal in that environment, and that some persons discover that they are particularly good at helping others to learn. Money doesn't solve all problems. We have the presupposition that you can't prepare teachers without teacher-training college programs. Well, the problems may well be insoluble within the constraints of the present system. But the teaching-learning enterprise does not need to take place in the regular school structure; it can occur in all kinds of settlement situations.
John Bremer
Director
The Parkway Program (Philadelphia)

It is true that a good teacher must be a good learner, but he must also be a good practitioner. The manner of presentation has got to be important.
Staff member of a teachers' college

The year at teachers' college ought to be the beginning, an introduction, not the conclusion of teacher education.
School superintendent

A teacher can lead with questions and still not be teaching pupils to guess what is in his mind. Rather, such a strategy can help pupils to ask intelligent questions themselves.
High school teacher

I believe that the identification of teachers ought to begin earlier and their professional growth ought to be extended. Up to the present, there just hasn't been enough coordination among the different jurisdictions to do the job properly. The question in my mind is whether we ought to have special institutions for the preparation of teachers — maybe we as training institutions don't need to exist. Personally, I did more to bring teachers along before I entered the teacher-training institution. Part of my concern is the one-year pattern; perhaps we should have much more flexibility to accommodate students' diverse needs. And part of my concern is related to numbers. I don't have the personal contact I would like to have.
Staff member of a teachers' college

The graduate of today who teaches for forty-five years will see his role transformed innumerable times. At some point in his career, he may teach entirely over television. At another time, he may work entirely as a creator of written materials for children. At yet another point, he may be a director of a computer-based instructional center. Because of this, the teacher-innovator program must give as much attention to the teacher as an institution builder, as a scholar, and as an innovator, as to his role in working directly with children. If the teacher-innovator program is successful, the teacher will be able to help shape the institution in which he works, to teach himself new roles, and to test new educational ideas. . . .

Most educational innovations cannot be accomplished by teachers working alone. They require institutional change and institutional commitment. Therefore, the school and the school district are the units with which the teacher education program must cooperate; and within schools devoted to scholarship and innovation, experienced teachers and teacher candidates can work together in joint inquiry. . . .

The present state of knowledge about teaching and learning is such that the teacher who would live rationally must be a competent scholar of teaching and learning. He must be prepared to create and test original solutions to educational problems. He must be prepared to create, study, and, if necessary, research curriculum materials that are prepared by other people. And he must be prepared to create with his colleagues what Robert Schaefer calls a school that is a center of inquiry. . . .
Bruce Joyce
Teachers' College
Columbia University (New York)

The finer-grained analyses of the school's shortcomings to which we are treated in the popular educational journals show us a tableau in which each element is apparently vying with the others for the title of 'supreme irrelevancy'; included among the villains are textbooks, classrooms, teachers who inform students (rather than letting them 'discover'), educational administrators, all items purporting to represent fixed knowledge, and any regulations which constrain student movement or choice. If future historians are to do us justice, surely they will be obliged to refer to our time as the Age of Irrelevance. . . .

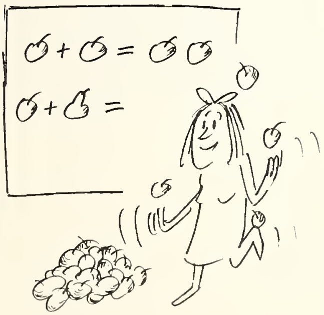
Among educators in our province, a widespread point of view as to how relevance is to be acquired is that we should throw the whole burden of discovering relevance back on the child. The proposal here is compellingly simple: put the child in a free environment and he will define his needs for us, will tell us what is relevant *for him*. . . . John Holt puts the matter more squarely by asserting that most of the major ills of North American education would disappear if the child were allowed to determine what he is to learn and when he is to learn it. While we may have a good deal of sympathy with this viewpoint, recent experience surely has taught us that children, if left entirely to their own devices, will as often choose the trivial and ephemeral as the worthwhile and lasting. For example, is it not true that ninety percent of the so-called 'research' or 'independent study projects' conducted by elementary school children in this province constitute little more than practice in juvenile plagiarism from standard reference books? The notion that children who are working on their own *must* be doing something worthwhile seems to be so widespread among our young teachers that it is actually considered an impertinence to ask whether the child has produced any product of value to himself or anyone else. . . .

It seems to me that attacks on the notion of rationality are likely to reactivate the ancient distinction between the 'cognitive' and the 'affective.' Most of us grew up and taught in a period when it was common to *say* that the child had both an affective and a cognitive side but to plan and evaluate our instruction solely on the basis of its contribution to cognition. . . .

But the active involvement of a considerably wider group of people in public education would require a much clearer delineation of teaching functions than we presently possess. In other words, we have to replace our gross distinction between 'teaching' and 'non-teaching' with a hierarchy of defined teaching skills capable of differentiating the central and inescapable tasks of the professional from those which can be capably undertaken by a volunteer. . . .

By the time the student reaches teachers' college, then, he should have progressed through a series of teaching experiences and have had some firsthand experience at improving the teaching-learning situation. Formal teacher training would then be a culmination of these experiences, or at least a high plateau, rather than a mere beginning, as it is presently conceived.
Floyd Robinson
OISE

As those of us who work in colleges of education recognize, no matter what we try to do to introduce teaching innovations, most of our students are influenced chiefly by what was done to them by their teachers for thirteen years in elementary and secondary school. The little that can be done during the year at teachers' college is often undone as soon as the student finds himself in a teaching situation. . . .



What I am saying is that we have to look at the learner from where he is; and perhaps the job of selecting and training teachers should not involve so many higher academic qualifications but should be concerned with other things like ability to relate to the learner. . . .

One has to face the problem that perhaps there is a sequencing and pacing for innovation that has to fit within the system. If, for example, one introduces an open-class system and automatically imposes it on teachers who have not been trained to use it, many of them will drop out. Or even if they are trained but are not prepared to cope with complaining parents, they may also drop out. So we have to look at the system in its totality to cope with these problems.

There is one last point I am concerned with and that is the question of the 'art of teaching.' I take offense at this term for a number of reasons. I think we call something an art whenever we cannot describe what we are doing. And if a man is teaching 'artfully,' I would like to be able to examine how he is doing it and find some way of teaching others to do it too. I think that this is the kind of research we should be concerned with. Practice and theory should not be divorced. If something is working 'practically,' then there must be a theoretical explanation for it. This should be the concern of the colleges and schools of education.
Ralph Dent
Ontario College of Education

A CENTRE FOR SCIENCE EDUCATION

A. L. Mansell, Chelsea College of Science and Technology, University of London

A physiological experiment in one of the Centre's biology laboratories.

Chelsea College of Science and Technology has its heart in one of the most expensive areas of London, on 'swinging' Kings Road. If one swings far enough west, however, one arrives at a district that has not yet arrived socially—where antique shops give way to junk yards and smart restaurants to fish and chip shops. This is Parsons Green, a sea of Victorian and Edwardian terraces in the midst of which, set like a whitewashed rock, is a converted factory whose architecture defies description—the Centre for Science Education's temporary home until a site can be found for permanent, purpose-built accommodation. Inside this building is housed a powerhouse of educational activity and a vigorous community of staff and students.

The Director of the Centre, Kevin Keohane, holds the first Chair in Science Education at the University of London. The staff is composed of physicists, mathematicians, chemists, biologists, sociologists, and psychologists. There is, in addition, a resident historian. All have had extensive experience as teachers themselves and all are consumed by a burning passion for science education.

Among the research and development projects based at the Centre are the Nuffield A-level Chemistry, Biology, and Physics projects and the Nuffield Secondary Science Project. In October 1969, a new Schools Council Integrated Science Project was added.

Our biologists have two major projects on hand at the moment. The first is concerned with determining the needs of schools for animals and other living organisms and, going on from there, with devising culture, maintenance, and teaching techniques suitable for different species. The second project, which is sponsored by the ESSO Petroleum Company, is concerned with producing materials for use in schools that will illustrate aspects of conservation and care of the environment. This work links chemistry, biology, geography, economics, and history.

The primary purpose of the Centre, however, is to train science and mathematics teachers. Taking graduates in chemistry, physics, biology, and mathematics, it converts them in the space of one year into teachers of science. In addition, a two-year part-time course for practicing teachers, leading to a new degree, the Master of Education (Science Education), was recently inaugurated at the Centre. Allied to these courses are research activities leading to M.Phil. and Ph.D. degrees.

The Centre also holds regular inservice courses throughout the year to acquaint practicing teachers in the London area with Nuffield approaches and has taken the initiative in setting up joint teacher-university staff groups in chemistry that meet regularly to discuss problems of chemistry teaching and of the interface between school and first-year university work.

In this article I want to concentrate on the methods we use in carrying out our primary task of training young graduates for the job of science teaching. To begin with, there are no examinations in our courses; we use a system of continuous assessment, monitoring the student's progress throughout by reference to his or her performance in essay writing, laboratory projects, practice teaching, and producing a short dissertation. Each student is assigned a co-tutor who is a teacher on the staff of the school the student attends for a twelve-week period of practice. The co-tutor scheme binds the Centre to the schools in a particularly effective way, and co-tutors play a valuable role in both training and assessing the student.

Our courses are firmly based in the science laboratories. Every student takes a main-method course—a chemistry graduate, for example, would do chemistry main method—in which he is trained in modern teaching methods and the use of up-to-date equipment. Both traditional and Nuffield approaches are taught, and attention is given to relevant aspects of such American schemes as Chem Study, P.S.S.C., and Harvard Physics. Every student also takes a minor-method course, where he gains experience in a subject with which he is less familiar—a mathematician, for example, might do minor-method biology. Because most science teachers are required to teach outside their main subject in the lower school, the minor-method course can be very useful. Integrated Science, which looks across the board between physical and life sciences, is especially popular. in addition, students are introduced to the complexities of audio-visual aids. They learn to make their own films, filmstrips, and slides, to use projectors and recorders, and to operate closed-circuit television, all under the direction of a former BBC producer.

As I stated before, we set out to convert graduate scientists and mathematicians into teachers of science and mathematics—quite a different species from practicing scientists. The teacher is a man or woman concerned with the total education of the child, and science and mathematics are only a part of that process. He must learn to stand back and see his subject in a wider context, to look at it in a less xenophobic way, to accept that all do not love physics as he does, and to walk successfully that tricky tightrope between the platonic and the vocational abyss.

Conventional degree courses, while they may produce admirable scientists and mathematicians, tend to be narrowly subject based. They seldom provide opportunity for the more open-ended type of discussion that is inevitable in the social science fields, of which education is surely one. Our most difficult task, initially, is to help our students break out of the convergent modes of thought to which they are accustomed and get them to think out and discuss critically their roles in the classroom and the implications of these roles in the wider context of society. I like to call this painful process our 'mind-bending' exercise.

We have no formal lecture series on psychology, the history and philosophy of education, educational administration, and so on, culminating in written examination papers. Instead, we have four lecture series, comprising ten lectures each, on the following general topics:
1. The teacher in the classrom. This series is built around a study of the psychological aspects of the teacher/child relationship.
2. The teacher in society. This series considers the social aspects of the teacher's task and places his work in the context of modern society.
3. The curriculum. The emphasis here lies on the type of decision making that goes into the planning and development of curricula.
4. Science, mathematics, and education. This series examines science and mathematics as components of the total educational process.

The lecture series is regarded as seminal; many lectures are deliberately provocative in content so as to disturb students and set them arguing among themselves and within the study groups that follow. Each group consists of some ten students of mixed disciplinary backgrounds who meet weekly with a staff member. The groups provide their own dynamics, taking up points from the lecture series for further discussion, inviting experts from relevant fields to sit in when required, and arranging visits to schools, museums, or even prisons as they follow up problems raised in the lectures. The student is thrown firmly onto his own resources in the study group. The staff member offers advice or prompting at suitable points but makes no attempt to lead the discussion.

At first, some students are resentful of this treatment and demand that we be more explicit than we appear to be in teaching them how to teach. By the end of the first term, however, most see the logic of our approach and realize that we are trying to make them experience within the context of their course at the Centre the kind of catalysis they will be striving to bring about in their own teaching.

Building on the student teacher's knowledge of a specific scientific discipline, the Centre strives to instill in him not only an academic knowledge of modern teaching methods and curricula but a basic understanding of how to initiate action, spark discussions, and think his way through the complex human relationships that will develop in the classroom. Through insight into manipulating the factors that affect learning, the student learns to become a better teacher himself.

This child with a student teacher typifies good relationships that have been built up with local schools whose children visit the Centre.

LAKEHEAD

District R.C.S.S. Board Seminar Program

In another age, when households were subjected at regular intervals to visits by the local dressmaker, the old maxim about 'cutting the garment according to the cloth' had very literal application. Nor was its application confined wholly to garments and cloth, for it embodied a philosophy that had significance in many fields of endeavor.

The day of the community dressmaker is gone, and almost as completely has disappeared the homespun philosophy associated with her trade. Almost — but not quite — for once in a while, even yet, it comes dramatically to life. Such was the situation last year, when the Lakehead District Roman Catholic Separate School Board, responding very early in its life to an urgent need to 'equalize' the educational opportunities offered in its schools, shaped from the fabric of existing facilities a 'garment' appropriate to its task. The 'garment' took the form of an extensive inservice training program designed to update and upgrade the professional staff of a system brought into being on New Year's Day, 1969, by the amalgamation of the Catholic school boards of Fort William, Port Arthur, Neebing, and McIntyre.

The rationale underlying the Lakehead District program was enunciated by Superintendent Guy O'Brien: 'The model of inservice training was predicated on many needs . . . not least of which was an economic limitation which precluded the more orthodox and common investment in educational material, building construction, and professional educators.' Commenting on the need for intensive professional development, Mr. O'Brien explained that 'in actual practice this means helping teachers to rethink and mobilize their philosophy, to perfect their teaching techniques, and to become immersed in new programs.' In a succinct summary, he described the program emphasis as concentration on people rather than material.

The entire project is at once intensely practical and highly imaginative. Practical, in that it focuses upon a more efficient use of resources; imaginative, in that its development cast vision in the role of catalyst. Work began with a searching evaluation of available resources — both human and material — and the resulting inventory made up the fabric. Design that had to this stage been vague became more clearly defined, and guidelines emerged. Using these guidelines, the administration constructed a program through which, in the fall of 1969, inservice training was made available to every teacher on the staff of the Lakehead District R.C.S.S. Board.

In keeping with the philosophy of utilizing existing facilities, the home selected for the seminar program (as the inservice project is called) was a vacant four-room country school in the village of Baird. Minor renovations, carried out by the Board's maintenance staff at a cost of less than $3,000, fitted the building for its new role. Named The St. Augustine Centre, the building opened in the autumn of 1969. The Centre's supply of equipment and instructional materials came largely as an expression of the generosity of local schools and the Board's Audio Visual Centre. Its site possesses many natural advantages, not the least of which is the wealth of raw material it affords for environmental studies. Within a radius of a few miles are the Kaministiquia River, Kakabeka Falls, various types of farms, a stable of quarter horses, a turn-of-the-century general store, and a gliding club. Small wonder that workshops in outdoor education are popular and rewarding.

During the 1969/70 school year, a nine-member committee coordinated by Frances Moscall, the Board's Primary Consultant, directed the operation of the seminar program. Serving with Miss Moscall were the superintendent, the assistant superintendent, three principals, one vice-principal, the audio-visual coordinator, and two teachers. Through regular weekly sessions, the committee kept closely in touch with affairs at St. Augustine and conducted overall planning and constant evaluation. As the year progressed, the ability of the program to perform its functions of updating and upgrading the professional staff was effectively demonstrated, and both teachers and administrators saw in it a potential for ongoing enrichment that warranted extension of its experimental lifetime. Consequently, it was decided to continue the program, in modified form, throughout the 1970/71 school year.

Workshop sessions at St. Augustine normally have an enrollment of nineteen teachers and last from one to four days.

Do You Believe That...

Outdoor education seminars involve teachers in trying out new skills.

An informal discussion among teachers during a religious education seminar.

Pupils often participate in the inservice training workshops at the Seminar Centre.

Participants are relieved of anxiety about their regular duties, for their classes go on as usual under the direction of the competent nineteen-member staff of supplementary teachers recruited for this purpose. Since actual working time is recognized as one of the most precious workshop resources, there is no pre-session registration or lengthy introduction of speakers; continuing attention to organization seeks to ensure the richly productive use of every day. Workshop leaders are drawn from many sources, but wherever possible the seminar program capitalizes on the special competencies of Lakehead teachers and other talented local people — a course originally adopted as a result of a last-minute failure to get a specialist from outside and retained because of its unexpected fruitfulness.

Program offerings run the gamut of traditional study areas and include a number of specialized fields such as the experience approach to learning, drama, outdoor education, instructional materials usage, drugs, orientation for new teachers, local history, and continuous progress in schools. Future offerings will also include the philosophy of education and professional development for principals. All decisions concerning subject areas to be covered reflect the thinking of teachers, principals, administrators, and board members. During the 1969/70 school year, two workshops—religious education and family life—were compulsory for all teachers, and each teacher was permitted to attend five additional workshops of his own choice. For the 1970/71 year, the number of required workshops has remained unchanged, but the optional ones have been reduced to two. This action is designed to reduce the teaching load of members of the supplementary staff so they may play a more active part as resource personnel in the schools.

In June 1970, following a full year's operation (185 workshop days), the seminar program gave every indication of having progressed far in accomplishing its purpose. The increased awareness of teachers, expressed in fresh and stimulating programs of learning, was already producing new enthusiasm on the part of the pupils. In terms of the system as a whole, it was apparent that the experiences at St. Augustine were contributing effectively toward molding a united staff from the teachers brought together by the creation of the new school board. The workshops were a rich source of professional renewal, but their value extended into personal lives as well, for they afforded relaxation, a change of pace, and what was simply described as 'fun' by the teachers involved. Their ability to bring inservice training within the scope of the regular school day was hailed as a significant educational advance.

Members of the 1969/70 seminar committee are quick to acknowledge the cooperation and support of many people from their own area and beyond. Assistance was given by representatives of community organizations, farmers, members of the medical profession, Department of Education personnel, educators at all levels, and persons with special competence in a wide variety of fields. Services have been given voluntarily, for the most part; only in rare instances has the question of payment arisen. Whether community involvement will ultimately produce a better understanding of what the schools are doing and why, as a by-product, cannot be determined as yet —but the potential is there.

At this time, the pattern of the seminar program beyond the current school year is uncertain. It must be remembered that the program was established for a specific and immediate purpose—a purpose that gives promise of being accomplished by June 1971. Because of this, further modifications or alternative approaches to the inservice training of staff may well be implemented. One area where no change is anticipated is the Board's policy of granting each of its teachers the privilege of visiting one school system or attending one educational conference a year at Board expense, as long as funds are available. Such activities are seen as means of reinforcing the updating and broadening functions of the seminar program. As a further safeguard against parochialism, or an inward-looking attitude, the administration is making an effort to involve more outside educators in the 1970/71 program.

Commenting on the seminar program last spring, a local trustee—a lawyer by profession and father of three school-age children—stated, 'It is a unique system of teacher education, and it works.' Officials of the Lakehead District Roman Catholic Separate School Board agree on both counts. Experience shows that the system does work, and failure to date to find, on this continent, a similar program operating on such a widespread and continuous basis lends support to the claim to uniqueness.

CHILD

Child hands,
searching, exploring,
moving environments,
lifting your world—
how can we help you
to feel?

Take me out into the world
to touch and
handle reality.
Bring me the world of people
and things,
not just words.

Child eyes,
wondering, wandering,
pleading, beseeching,
surveying your world—
how can we help you
to see?

Show me things of the
world that will delight me
because of their beauty,
perplex me because
of their ugliness.
Let me see everything.

Child ears,
listening in wonder,
to sounds of the universe,
sounds of men's minds—
how can we help you
to hear?

Give me the chance to
listen to enjoy, to
listen to criticize, to
listen to respond. Let
me learn to listen and
think.

Child limbs,
moving, responding,
expressing, revealing,
your intimate selves—
how can we help you
to move?

Give me freedom to
move in response to
my moods and thoughts.
Let me move to moving words and music.
Let me create beautiful
forms with my body.

Child tongue,
asking and telling,
forming, inventing
words about worlds—
what can we help you
to say?

Help me to tell myself
about the world;
and to tell the world about my self.
Help me to tell myself about my self;
and to tell the world about the world.
Help me to be caring and precise
in how I tell it.

Child mind,
asking, inquiring,
anxious for meaning,
wanting to learn—
how can we help you
to know?

Help me to go on
inquiring. Teach me
the ways to find out.
Be patient with my
meandering steps along
the way.

Child heart,
beating, repeating,
reflecting your pleasures,
reacting to fears—
how can we help you
to love?

Show me that you love.

John A. McInnes/OISE

Kids Deserve a Natural Hi

A proposal for new schools by evolution rather than revolution

R. G. Des Dixon
Executive Assistant
Ontario Teachers' Federation

Maybe the kids are three years old and their school happens to be called a nursery school. Maybe they are twenty and their school happens to be called a university. No matter what age, every kid deserves a natural Hi and a Living Room.

'Hi' for Human Interactor, and 'natural Hi' because effective human interaction skills cannot be put on — they have to be felt, basic, real, natural.

The Hi is a person, an adult. He is not a teacher in any usual sense. So let's not call him a teacher. Nor should we call his room in the school a classroom. It is a Living Room — a place to live — for twenty-five kids and their Hi. All other rooms and personnel are supportive.

Picture a typical Living Room in a typical school. Most of the twenty-five students appear to be from fourteen to seventeen years old. It is a bit unusual for all twenty-five to be in their Living Room at 10:30 on a Wednesday morning . . . Three are making coffee and buttering muffins in the kitchenette corner.

Five, seated in easy chairs that converge on a coffee table, are discussing a war story in the morning paper. A sixth, seated in the coffee-table group, is reading another story in the paper.

Nine occupy study carrels, or small tables, along the sides of the room.

Three are arranging pictures, projectors, and other visual aids on a seminar table.

Two are consulting over a textbook.

One is asleep on a couch.

Two are making a sign at the work counter.

That totals twenty-six. One is the Hi. Which one? Oh yes . . .

One of the three at the seminar table looks older. He leaves the seminar table, walks over and comments favorably on the vivid color of the poster, then continues to the carrel area where he talks intently to a student. From there he goes to the coffee area, where a student pours coffee for him and shows him her new ring. Coffee in hand, he goes over and listens for a few moments to the newspaper discussion. Still standing, he contributes an idea to the discussion. One boy disagrees. The Hi sits down with the group and explains his point.

Five minutes later one of the students at the seminar table clears his throat and pitches his voice to reach the whole room.

'Could we have your attention now please?' He pauses for a few moments while people finish sentences and turn chairs. 'Sorry we're a bit late starting. Trouble with the projector. John and I want to thank you for coming to our session. We know most of you are involved in important things of your own. Ruth even came back from her week at the planetarium. . . . Thanks, Ruth.

Anyway, John and I have shot movies and slides to develop a presentation on urban ugliness in our town. It might be good to move your chairs in closer. . . .'

At 11:00 two students from another Living Room enter quietly to hear the presentation. Ruth leaves at 11:15; she is due back at the planetarium. Another student leaves at 11:25 because he has an appointment in the Reading Laboratory.

Shortly after, the sleeper awakens, has a coffee and tunes in to urban ugliness. All of this is merely the pulse of life and goes unnoticed by the presenters and the audience.

Meanwhile the rest of the school hums with life too—not bells, just life. There are many people in Living Rooms of course. Every student belongs to one, and every one has a Hi.

But there are other kinds of rooms in the school as well. The *resource center* is huge. It has books, films, carrels with electronic equipment — in fact, every imaginable source of data. It is a data bank staffed by experts in various technologies. Librarians assist in finding data. Technicians help with equipment. But the students work independently. Generally speaking, every Hi knows which of his students are in the resource center, though this is not important.

The school also has *instruction centers,* where live instructors present lessons at scheduled times. In the mathematics instruction center, beginning algebra is offered to groups of volunteers almost every semester. The same is true for physics, typing, English composition, electronics, and many other 'subjects.' Lecture centers accommodating a hundred or more students are used where appropriate.

Another type of room is the *laboratory center.* There are one or more for every 'subject.' A student interested in mathematics, for example, might work on his own in the mathematics laboratory, or he might have an appointment to work with the lab tutor on some particular interest or problem in mathematics.

And finally the school has *project and studio centers,* many of them places where the adult in charge actually pursues his lifework all day long. In the theater project center, a professional producer stages plays. In the mathematics project center, a mathematician actually pursues his discipline. In other project and studio centers, an artist paints, an automotive engineer designs cars, and so on. A factory provides an electronics project center; a local theater provides its rehearsal hall.

In project centers, students with sufficient interest and background join in the work rather like apprentices. Studio centers are more elementary in approach and appeal to students who wish to try their wings in a given activity. One of these is a large general center, rather like a vast, rough, art-construction workshop.

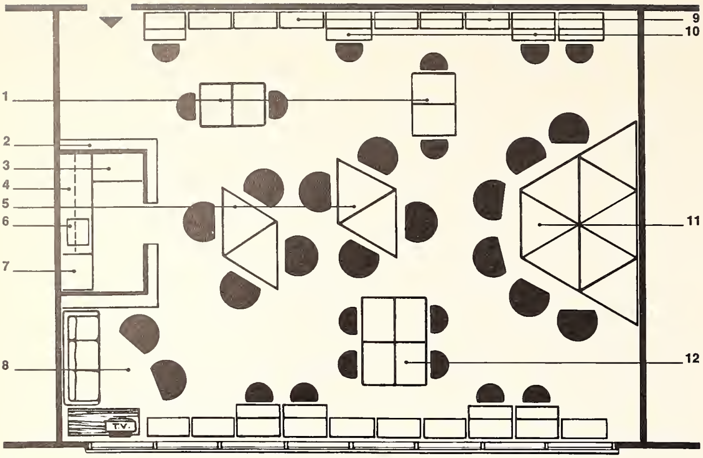
The Hi-way (the Living Room/Hi concept) is not revolutionary, but evolutionary. Today's teachers could become tomorrow's Hi's, instructors, and lab tutors. Today's librarians and education resource technicians (teacher assistants) could continue their present work. Project center directors could be recruited from the community as needed. Even today's buildings could be used, although in the long run, it would be sensible to adapt old buildings and build new ones to facilitate the concept. Similarly it would make sense to prepare faculty members through professional education courses designed to train them for specific roles.

We will never get first things first in schools until we distinguish information-giving and skill-building from human interaction and self-discovery. The information-giving/skill-building tradition is so strong that few educators, and hence few schools, can make the necessary reversal in emphasis.

The common fault of most proposed school improvement schemes is the naïve assumption that one person can perform all the roles demanded in the schools of today and tomorrow. This is patently impossible. The sooner we realize that the old concept of a 'teacher' is dead, the sooner we can get on with defining and naming roles.

The Hi does not present lessons. He does not teach courses — ever. He does not have a timetable. When subjects are specifically taught, the teaching is done in instruction and lab centers.

Every Hi is a generalist, a man of many interests. He is tuned in to the wider world and particularly to the world of the young. He is also a person with avocations. Perhaps he writes, paints, invents, flies. Maybe his thing is economics or psychology or history. But most of all he is a warm human being, a *gentle* man, sensitive and open. He likes to talk. He likes to listen. He hears. He is absolutely convinced that every young person has dignity and worth. He is an idea man — a basically creative individual.



1 Private study

2 Book and magazine shelves

3 Storage and files

4 Fixed facility storage etc.—everything else portable

5 Low height coffee tables & lounge chairs

6 Sink

7 Refrigerator

8 Television corner

9 Personal storage units

10 Desk

11 Poetry reading, music, informal lectures
—movable triangular shaped coffee tables formed to serve as stage-platform. These units are on casters and can be split to form casual groups
—stage platform can be expanded or contracted by the addition or subtraction of tables

12 Conference

Design consultants: J & J Brook Ltd

Most of the essential qualities must be inborn. To this base of natural qualities can be added useful skills: how to organize groups; how to carry on discussions and seminars; how to turn over the organization of groups and discussions to students (the successful Hi works himself out of every situation as soon as the students are able to take over); how to get kids comfortably self-propelled; how to observe group interaction skillfully. Dozens of general and specific skills come quickly to mind. Knowledge from various disciplines would also be valuable.

The instructor or lecturer is a different sort of person. His first love is his subject. He is concerned with efficient teaching techniques. His questioning is polished. He uses technology to enhance his presentation. At times he may use seminar methods, but he is the real leader and key resource person, and even in seminars the subject is uppermost.

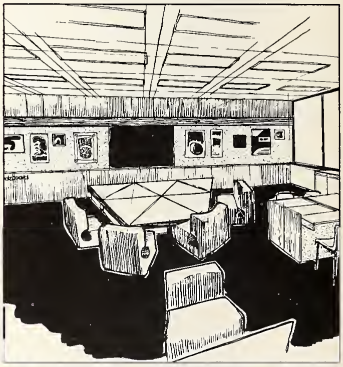
The lab tutor is also a subject man, but he has less interest in 'performing' before a group. He enjoys working with one person at a time on specific problems or interests. Within his subject he is aware of remedial techniques, programmed materials, and indeed everything required to assist and stimulate individual growth.

How much time does a student spend in the Living Room, and how much in other areas? It depends on the individual and it depends on the level. Very young children may spend virtually the entire day with the Hi. The need for varied instructors and tutors will increase as a child grows older. By age sixteen, a student may spend half his time in the Living Room and the rest on living activities in the resource center or the community. Or he may become so involved in the project centers that he is absent from the Living Room for weeks at a time. Throughout, the Hi will be in close contact with every student, helping, encouraging, stimulating, advising, and evaluating.

Evaluation of student activity in the Living Room will be largely subjective, a dialogue between the Hi and the individual student. At times it will be appropriate to include parents in evaluation discussions and at times it will be desirable to include groups of students. Some objective evaluation may become useful if satisfactory instruments are developed, but a higher priority attaches to the need to refine our subjective evaluation skills. Even this is not crucial, for the stuff of learning does not submit to easy measurement.

In instruction and lab centers, the ideal might be to assess levels of achievement frequently through standardized tests in cumulative subjects and skill development areas. Such information would be useful to instructors, and particularly to lab tutors, in planning further activities. Of course, the students would also be interested in their test results. But such information should never be public business. The most a school should ever tell the public are the activities (courses, projects, lecture series, etc.) the student has taken part in.

Of course many compromises are possible. If, as an interim measure, we must have examinations, marks, and credits, these could be minimal and confined to activities outside the Living Room. Or they might be provided only at the request of the student. That is, the student who wishes to accumulate course credits to satisfy the entrance requirements to some other institution or qualify for a particular job might ask for examinations and essays with marks, semester hour totals, or whatever other quantified statements are required.



We might also compromise on other matters in order to make a reasonably smooth passage into the future. For an interim period, we could retain compulsory attendance, report cards, and required courses, though eventually these should be retired to the green pastures of history where they belong. Even grades, levels, homework, and detentions could be retained. . . . But heaven forbid!

School must become relevant — a place to live, a here and now place, not a place to get out of. To accomplish this we must put the emphasis first on satisfying human relationships and second on self-propelled inquiry. There is no room at all for forced memorizing and required courses where the child is told he must do thus and so in order to prepare for tomorrow. The deadly result of that approach is an individual numbed to the excitement of life today. He waits for some promised tomorrow, and waits and waits.

In the electronic age life is today, the Living Room is the place, the Hi is the man at the center.

The Perception Bag

C. Kenneth Johnstone / Cambridge University

Photographs: Pamela Harris-McLeod

The Media Group make integrating learning devices. Following on their success with *Ten Years in a Box,* a kit on the 1930s (reported in *Orbit,* October 1969), this year they've launched a more daring probe — 1,000 boxes, each containing 1,000 exciting items that lead to perception. This time the Group — David Stansfield, Anthony Barton, Pamela McLeod, Shirley Collyer, Gayle Hollins — who man a project in the Computer Applications Department at OISE, got some help from Linda Zwicker and Paul Schafer of the Ontario Arts Council, which contributed $5,000. On a Spartan budget of a dollar a pound they crammed each of the bags with seventeen pounds of records, film, pictures, books, posters, bumper stickers, spices, pieces of wood. Here is an independent evaluation of the Bag, along with some comments from teachers and students.

Learner's v. Teacher's Aid

It seems to me that the Perception Bag proceeds from an admirable idea of education — 1) to offer the student an experience, 2) into which he may gain an insight, 3) out of which he will be moved to action. So it offers photographs of aggressive poses set side by side to show their likeness and difference in such a way that the student may grasp what emerges from the comparison, as in the Huey Newton/Imperial Wizard poster, in which Black Power and White Supremacy are seen to be equally aggressive and the color difference insignificant, an irrational ground for preference and in the context unenticing. The insight 'insignificant difference' and the judgment 'valueless' are left to the student to form. The perception, if he gains it, will be his.

On the other hand the materials have been selected and put in focus. Besides setting up the interface of this poster, the Media Group have put along with it a large number of contrast pieces that may stimulate the student to make comparisons. In this and other ways (e.g., questions) a response is directed. Yet it *is* a bag, a loose collection of varied pieces piled helter-skelter so that the work of comparison is invited more than directed. And further experience, insight, and judgment that would inform and qualify a rather naïve position (e.g., 'insignificant difference: valueless') depend on many factors largely uncontrolled: the time, place, and manner in which the Bag is made available to the student; whether he finds the contents interesting, and how interesting; how readily he may pursue an interest.

Do-It-Yourself Kit

Though the Perception Bag is conceived as a do-it-yourself kit for young people's use of media, personal exploration may be undercut by institutionalized learning. Masses of building, and standard, regular windows, doors, desks, periods, fit the children as well as the adults into inert patterns that inhibit spontaneous or even active use of the Bag. I noticed that many teachers tended (unasked) to *tell* the students what they had picked out, what it was for, how to use it, etc. In trying to gauge the force of teaching that is as new and different as the Bag, allowance has to be made at every turn for the countervailing forces of present system.

Sensory Experience

It is a 'perception' bag in another, basic, meaning of the word — in offering a considerable, varied, sensory experience. Posters, cards, booklets, and filmstrips offer a lot to look at as well as understand; celluloid has a special feel to it, and so on. It is remarkable how users immediately clutch handfuls of film, start handling the chopsticks and playing the records. They play and replay the Chinese voices. They seem hungry for pleasurable feel and sound.

The Media Group may hope that users' preference for the tactile and aural indicates a wholeness in their response (and help it by including smells, the most integrating sensation). In fact the users of the records and the plastics move more readily from 'consumption' to 'production' (doing something with the materials: sometimes doing startling things — some little girls cut up film to make rings and bracelets). Wholeness of response is particularly important as the Bag is not especially rich in sensory experience and is evidently designed more for insight into experience than for sensation.

Soft Evaluation

Before I make any more generalizations about children's responses, let me mark the limits of my statements. Since most of the Bags were already distributed and senior classes over for the year when I began this evaluation, I was able to take only a small random sample of student response. I brought the Bag into grades 1 and 6 at Flemingdon Park School. For such a small sample, the students were fairly representative of the median of our urban population — mixed racially and low income. They were a severe test of its effectiveness since their highly structured environment and disciplined life seemed more likely to provoke freaking out than spontaneous perception. The great majority were quite inhibited to begin with. The Bag roused the perceptivity of most of them, but this uniform response is more significant since it is by definition spontaneous and should mark a predictable effect of the Bag. Still, my tests were not a controlled scientific experiment. My measurements were not quantitative but qualitative, leading to a 'soft' evaluation. My classroom observations proved valuable for testing my own estimate of the Bag; they were reassuring in confirming many of my impressions. What struck me as inventive and surprising items proved exciting and stimulating to youngsters too. Children like the feel of a single chopstick. Sometimes they happen on the second, sometimes look for it. They may use them for drumming; they may try to pick things up with them; they asked the Chinese boy in one class how to use them, and he showed off his prowess. The records seem peculiarly attractive, to touch first of all; and when someone has taken the record, others want the envelope. At least half a dozen cluster around the player, pleased apparently with whatever comes out. Sometimes they play bits or whole records over and over; these may be folk-singing, the theme from 'Startrek,' new languages. Perhaps all are aware at least that something is playing, from time to time looking up at the record player or moving their heads or saying a few words about it. A loud voice or raucous sound may prove intrusive, and they call out 'Turn it off!' Conversely, for much of the time it seems to stimulate many of them to perception, for the most part not obviously related to the recording.

Active Response

It's tempting to suggest that the Bag induces an atmosphere for perception, that is, spontaneous learning. In fact it tends to set up an environment for active response to experience. The youngest children grew frenzied when the player was turned off. Without a lot of controlled experiment and scientific observation it would be foolish to try to determine some causal relationship, but the connection with the Perception Bag may be illuminating. In a disciplined grade 6, many of the pupils held back from the initial excitement. They may have been more self-contained, or self-conscious, or inhibited, than the first grade, which plunged in, somewhat greedily. But the response is analogous to the 'cool' of sophisticates and bears out the contention that excitement is exhausted from instruction under the tight control of the higher nerve centers. Wonder plays where restraint is not felt.

All the adults, and some pupils who were stolid in conversation, were more nervous than I about the consequences of free play. A few boys did goof off, and the youngest needed some vigorous games with me (piggyback, tag, football) to release energy or excitement or whatever. Yet perhaps companion to this was a perceptible rise in psychic energy throughout the class. I've rarely been among youngsters where there was so much excitement in the air, and so much mental activity — questions, exchanges, concentrated reading, experimenting. The adults who came in and out remarked it — a little pleased, a little puzzled, a little apprehensive.

Nourishing Curiosity

Novelty in the classroom partly accounted for their eagerness to try all the tactile things — the burlap bag, the cloth testimonial, the plastic cushion, the X-rays, the stickers. But to all those, and to the smells and spices and 3-D card and computer cards and posters, they brought an active curiosity. *Where is it from? How is it made? Those are the lungs,*

Comments on the Bag

'Please keep on getting into the classrooms via your boxes and bags. They were the first indication to me that OISE does more than sit in an ivory research tower.' *Doug Prokopec, Head of English, Lakefield District High School*

'I don't care what anybody says but I thought the Perception Bag was the best work we did all year.' *Tracy Spears, Grade 7 student, John G. Althouse Senior Public School, Etobicoke*

'[The Bag] has been a big hit in all instances—an excellent conversational piece, intellectually stimulating, and a source of "treasure" for the children.' *F. J. Speckeen, Principal, Cambrian College of Applied Arts & Technology*

'An evening with the Bag leaves hundreds of unanswered questions.' *Jim Carter, Principal, Sentinel Secondary School, West Vancouver*

'The Bag gave me more information about the various students than a year of regular classes could.' *Margaret Steward, Hanna High School, Alberta*

'You're very glib about it, but I'd like to punch you in the nose.' *O.C.E. summer student*

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aren't they? Can I get one of the heart? What's this? How do you use this? Did YOU take the pictures? Here is where the teacher comes in.

Consummate tact is needed to keep alive the spark of interest while opening up further exploration by the student. It would be much better for the teacher to withdraw, saying 'See what you can find out,' than to risk quenching that spark by being windy. He needs to be the soul of discretion, taciturn, dropping a hint, no more — 'Do you know what a collage is?' 'Maybe the answer's in the Bag.'

Print

The printed items seem to me the least active ingredient. Of course they aren't intended for the very young, or for everybody. Yet the most frequent question — 'Can I keep this?' — signaled too great a stress on consumption, too low a proportion of items raising the self-question, What do I do? Among those who read, to judge from the adults I tried it with and comments I've heard, the quantity of print in the Bag tends to intercept encounter with and perception through things. Of course reading stimulates comparison, but of ideas: just as the words are abstracted from reality, so absorption in reading means being locked within the mind. Even 'verifying the truth' throws the reader back to the argument. Only sensory experience keeps the student himself in touch with reality. The quantity of print in the Bag, then, undercuts the process that runs from sense experience to evaluation, and ultimately it would, I suspect, pinch off inventive mental life. Is that why we grow to be such sheep? Even our language is an uncritical repetition mostly of the jargon of advertisers, including sportscasters and disc jockeys. Why so much print in the Bag then? It is a compromise: the Media Group are the first to point out that the quantity of print was dictated by the problem of reproducing something cheaply a thousand times.

Verbalizing

The printed matter stands for a bias in our education towards talk — the teacher speaks the lesson, explains it, exercises and examines the student in it verbally. The serious students knew what they were supposed to do with the Bag — what the teachers did; read the print — and they felt guilty about the fun they had when they did something else like experiment with plastics or look at film or listen to records. They were uneasy, at a loss even, unless they were told to do something. Print — high definition — is totalitarian. It was practically inevitable that the Media Group would succumb to the pressure of telling what they were doing, and had done — in the 'Menu' and now 'How to Use the Perception Bag.' More subtly, subjects become issues to debate. Going beyond the expression of the makers' feelings about racial discrimination, the Viet Nam War, violence, the exploitation of women, adulterating food, those topics emerge as Causes. I am in sympathy with all their preferences, yet felt I was being hectored. The argumentative tone seems to come from the lineality of print.

Or from a different point of view and with a shift of emphasis, the intrusive presence of themes is the fault of being too explicit. Spelling everything out is not being clear but boring: there is no room left for the joy of discovery. Closure of ever so small a gap can lift mental work from drudgery to creation. Some teaching is dull through ignorance of human nature, but some through failure of nerve: we hardly dare trust man's innate intellectuality. Here the loss is slight. The Bag is rich in exhilarating moments and verbalizing is only a local or passing weakness that is certainly not fatal to its success.

Science v. Engineering

The Bag is innovative in being unstructured teaching (the field is choked with structured audio-visual education). The difference between the two kinds of education is like the difference between engineering and science, like the difference between the two Archimedes embodied in these vignettes: the engineer who said 'Give me a lever long enough, and a fulcrum big enough and I'll move the world'; and the scientist who leaped from his bath with the joyous cry, 'I've got it!' (the law of displacement). Educational engineering is limited to structured learning. Educational science could do more.

Note

The new wave of multimedia kits is spreading — the Royal Conservatory of Music now has its Music Basket, the Ontario College of Art its Art Box and year box (instead of yearbook).

The Bag was an experiment: no more are available now. But requests for them continue to pour in, and it is possible a commercial supplier may be prompted to respond to the demand. In the meantime, if you're interested in making up a multimedia kit yourself, and want to start with a model, you can obtain Ten Years in a Box *from the Media Group, OISE, which now has a second edition in preparation.*

Experimenting with Communications

Robert Kerr and Wilma Bagg
Ridgeway Senior School
Oshawa

In the 'traditional' elementary literature program, every child usually reads the same story from the same book at the same time and does the same assignments. This results in a large part of the group passively awaiting instructions, and causes many students to react with: 'We have to read some stupid story and then answer questions — It's a drag.' Such an approach is passé if we are to meet each child's immediate interests and needs.

Having had our old program so evaluated and recognizing a need for all-media literacy, we at Ridgeway evolved our present one. Essentially, it is an individualized program stressing an understanding of communications skills and an appreciation of the various techniques used in communication. It is not a panacea but a developing program in which the results so far have been encouraging.

As students commented in their year-end evaluations:
'Well, it's better than it used to be.'
'It's out of sight!'
'It's neat . . . you never know what you're going to do next.'
'My mother wanted to know where my reader was!'
'How about more themes about teenage topics like sports, drugs, and music?'
'I like to work on my own.'

At Ridgeway we make a distinction between functional and enrichment aspects of the communications program. These divisions are treated alternately in units of fifteen to twenty-five periods each. When a student comments, 'Communications, yeh, it's OK, at least it isn't the same thing every day,' we believe we are on the right track.

The Functional Aspect

The weaknesses of each student are assessed through diagnostic testing, and the necessary developmental work is then provided to overcome the problem areas. The program calls for the students in each class to be divided into groups

Pupils at an activity station answering activity cards.

Pupils returning books and handing out activity cards.

A pupil at a listening station pondering a question.

based on their reading, listening, and organizational abilities. The groups rotate among five stations, visiting each station once every five periods. Each student is given programmed exercises that allow him to work independently, free from peer competition, within each station. Each proceeds at his own rate and charts his own progress.

To emphasize that both the teacher and the student are working together to develop the student's skills, the charts are kept in a folder accessible to both. The students take great pride in charting their own progress.

Through informal consultations with their teachers, students learn to assess their strengths and weaknesses realistically and ultimately to accept responsibility for self-growth.

Our major concern here is to develop the skills necessary to be an 'effective receiver' of various communications media. At present, most emphasis is placed on the development of reading and listening skills, but we wish to develop skills in appreciating and receiving information from a variety of media, and we intend to expand our program shortly to include television and film.

Our original concern that students would dislike the structured format of skill-building exercises was unwarranted. Constant rotation among stations, we have found, gives sufficient variety of activity. Freed from large-group teaching duties, we are constantly consulting with students on a one-to-one basis. At first we initiated most conferences, but now students are coming more and more to us.

The Enrichment Aspect

This division is designed to foster the development of critical awareness and appreciation of techniques used in communications. It is hoped that students will be encouraged to expand their interests and become more discerning in their choice of media. Small groups pursue various aspects of some theme, making use of as many media as are practical in our situation. We are fortunate in having listening stations, tape recorders, record players, and motion-picture and slide projectors available at all times.

The freedom in this division results in a wide range of student-initiated activities. Last year, one group presented a 'Foul Weather Fashion Show' as their contribution to a theme on weather. A display of original cartoons depicting a visit to the Silent Cinema was an individual contribution to a theme on humor.

A maximum of twenty periods is devoted to any one theme, but within that limit duration is determined by student interest. Some recent themes have been animals, bravery, geography, humor, music, poetry, smell, space, and sports.

We are at present experimenting with mini, midi, and maxi theme units lasting five, ten, and eleven to twenty periods respectively. Students select their area of special interest in the theme. Those with common interests form groups.

Using multi-level guide cards, the students move freely to stations that contain the necessary individual and group equipment for use — filmstrips, motion pictures, records, and tape recordings, as well as a variety of printed materials related to the theme.

Another innovation we are implementing this year is an 'opt out' station where students can pursue a topic of their own choosing. Student response has been such that we don't feel this freedom will be abused.

Practice through Inquiry in Mathematics Learning

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'The royal road to mathematics is six examples a night, six nights a week, and twelve on Sunday.'
(From 'Fight for Education:
A Black Paper' quoted in *Orbit,* no. 2)

I hear and I forget
I see and I remember
I do and I understand.
(From a Chinese proverb quoted
on the cover of *Orbit,* no. 3)

Like all sayings, the two above are not expected to give the whole truth, only a part of it. But is it so simple? Does doing really lead to understanding? Does the solution of forty-eight examples a week really open the 'royal road to mathematics'?

As we interpret the word today, understanding means relating. A child is said to 'understand' a new idea or fact if he can relate the various parts of that idea one to another — and to the knowledge and ideas he has previously acquired — so that taken all together they will form an integrated whole. The question is, Do the exercises a child is expected to carry out at school really provide him with means for integrating ideas — the basis of understanding?

Another question related to the above is, How can we *make* the child do something? The answer, I think, is that the child has to be strongly motivated; and the motives have to be deeply rooted in his own needs. If we fail to generate such motives, then either the child will not do what we want or will not derive much benefit from it.

We may distinguish between motives, dividing them into extrinsic ones, which originate in the child's needs outside himself (as, for instance, the need for recognition by his peers), and intrinsic ones, which originate in the child's own central nervous system independently of any outside factors. Intrinsic motives are of great importance in the learning process. There is in every individual a need for stimulation, for learning to know his physical and intellectual environment. Novelty or complexity in the environment will attract the attention of the child and lead him to attempt to explain and resolve the complexity. Professor Berlyne, from the University of Toronto, coined an interesting name for this phenomenon — 'epistemic curiosity' (curiosity for knowledge).

It is particularly important that the teacher be aware of these facts. Teachers are now trained to organize the student's activity so that learning will be more stimulating and therefore more attractive to him. This way, the student will learn because he *wants* to learn and not because he *has* to. However, there is still one important area of the student's activity in mathematics learning where very little of this is done: drill and practice.

A large part of the child's time in learning mathematics in school is given to drill and practice. It is an accepted fact that merely exposing him to a series of concepts is not enough for him to master them. Drill and practice are essential if he is to use the concepts when needed and apply them in a variety of new situations.

Drill and practice can be broken down into three essentially different types of exercise:
1. Memorizing. The student repeats in its original form the material he has been taught.
2. Doing exercises. The student applies what he has learned to new situations similar to the examples he has been exposed to.
3. Solving problems. The student applies ideas inherent in the material to which he has been exposed to situations that seem at first very remote from those he has encountered before. In this case, he is expected to accomplish tasks by breaking up the new situation into its component factors and finding in it elements similar to those to which he has been exposed previously.

In most cases, teachers make greatest use of the first two types of exercise for drill and practice.

With the advent of new curricula, a large amount of material in mathematics has been transferred from the upper grades to the lower ones. Considerable effort has been devoted to making the material meaningful, which means relating its parts one to the other. But the need for a large amount of practice still exists, and in this area of classroom work nothing has changed. The child still has to carry out a large number of exercises, the only relation between them being the fact that they deal with the same subject area. He has to practice the addition of integers to master addition, to practice the solution of linear equations to solve them with a certain amount of speed, and so forth — the relation between one addition fact and another, one equation and another, being only some well-established rule. Each such exercise attacks one isolated point in the body of knowledge to which the exercise is related. The only goal that can be formulated for the child is that he has to master the area. Obviously, this approach taps little of the child's intrinsic motivation to relate ideas, and it is unlikely to arouse his interest.

The problem is even more difficult when it comes to remediation. The teacher who has discovered that a child's performance is deficient in a certain area of arithmetic or algebra diagnoses the deficiencies and then provides a series of exercises to remedy them. The child has nothing to arouse his interest in doing the exercises except his need for achievement; but this may be low. The fact that each exercise requires the application of a certain principle is not enough to serve as an integrating factor that will make the series of exercises more meaningful. The correctness or incorrectness of such exercises can be checked only by relating them to rules; they cannot be related to each other. And because the rules are prescriptions that don't involve the student, they don't provide either enough control or enough integrating power to improve his performance. This form of 'doing' does not always lead to understanding, and increasing the number of exercises will often increase the boredom but not the mastery.

There is a more meaningful way, however, by which we can lead children to gain needed practice in mathematics; and it is one in which the motivating factor provides a goal that goes beyond the completion of a set of exercises. Let us consider a few examples.

Assume the children have learned to add fractions, and we want to provide them with practice in this area. The problem posed them could be: Compute the sum $1/1\times2 + 1/2\times3 + 1/3\times4 + \ldots 1/14\times15$. As the attempt to find the common denominator of all fifteen addends will certainly lead to error and frustration, the teacher could provide a clue, and it should be the only one: 'Try successive sums.' (Or even better: 'There is some order in the denominator. Perhaps there should be some order in successive sums if we change the number of addends. How could we investigate it?')

Computation of these sums ($1/1 \times 2 = 1/2$, $1/1 \times 2 + 1/2 \times 3 = 2/3$, $1/1 \times 2 + 1/2 \times 3 + 1/3 \times 4 = 3/4, \ldots$) should lead to the conjecture that the total sum is

1. $[(x,y) \mid x = -15,\ 5 \leq y \leq 9] \cup [(x,y) \mid -15 \leq x \leq -13,\ y = 7] \cup [(x,y) \mid x = -13,\ 5 \leq y \leq 9]$

2. $[(x,y) \mid y = 2x + 27,\ -11 \leq x \leq -9] \cup [(x,y) \mid -10 \leq x \leq -8,\ y = 7] \cup [(x,y) \mid y = -2x - 9,\ -9 \leq x \leq -7]$

3. $[(x,y) \mid x = -5,\ 5 \leq y \leq 9] \cup [(x,y) \mid (x+4)^2 + (y-8)^2 = 2,\ x \geq -5]$

4. $[(x,y) \mid x = -1,\ 5 \leq y \leq 9] \cup [(x,y) \mid x^2 + (y-8)^2 = 2,\ x \geq -1]$

5. $[(x,y) \mid y = -2x + 15,\ 3 \leq x \leq 4] \cup [(x,y) \mid y = 2x - 1,\ 4 \leq x \leq 5] \cup [(x,y) \mid x = 4,\ 5 \leq y \leq 7]$

6. $[(x,y) \mid x = 10,\ 5 \leq y \leq 9] \cup [(x,y) \mid y = -2x + 29,\ 10 \leq x \leq 12] \cup [(x,y) \mid x = 12,\ 5 \leq y \leq 9]$

7. $[(x,y) \mid x = 14,\ 5 \leq y \leq 9] \cup [(x,y) \mid y = 9,\ 14 \leq x \leq 16] \cup [(x,y) \mid y = 7,\ 14 \leq x \leq 15] \cup [(x,y) \mid y = 5,\ 14 \leq x \leq 16]$

8. $[(x,y) \mid y = -4x + 81,\ 18 \leq x \leq 19] \cup [(x,y) \mid y = 2x - 33,\ 19 \leq x \leq 20] \cup [(x,y) \mid y = -2x + 47,\ 20 \leq x \leq 21] \cup [(x,y) \mid y = 4x - 79,\ 21 \leq x \leq 22]$

9. $[(x,y) \mid y = -2x - 10,\ -7 \leq x \leq -6] \cup [(x,y) \mid y = 2x + 14,\ -6 \leq x \leq -5] \cup [(x,y) \mid x = -6,\ 0 \leq y \leq 2]$

10. $[(x,y) \mid x = -3,\ 0 \leq y \leq 4] \cup [(x,y) \mid y = 4,\ -3 \leq x \leq -1] \cup [(x,y) \mid y = 2,\ -3 \leq x \leq -2] \cup [(x,y)\ y = 0,\ -3 \leq x \leq -1]$

11. $[(x,y) \mid y = 2x - 2,\ 1 \leq x \leq 3] \cup [(x,y) \mid y = -2x + 10,\ 3 \leq x \leq 5] \cup [(x,y) \mid y = 2,\ 2 \leq x \leq 4]$

12. $[(x,y) \mid x = 7,\ 0 \leq y \leq 4] \cup [(x,y) \mid (x-8)^2 + (y-3)^2 = 2,\ x \geq 7] \cup [(x,y) \mid y = -2x + 20,\ 9 \leq x \leq 10]$

Graphs of the set of relations above spell out a seasonal message. An equivalent set was given by the author to a class of grade 9 students together with the information that, when they had finished, they would find an interesting message. A similar set, but not one leading to a meaningful pattern, was given to a comparable control group of students. The first group finished in less time, made fewer errors, and expressed more interest in their work.

14/15. The next step would be to test the conjecture by increasing the number of addends. The highest step would be to obtain proof, which in this case can be obtained by rewriting the sum in the form (1 – 1/2) + (1/2 – 1/3) + (1/3 – 1/4) + . . . + (1/14 – 1/15).

The child who is investigating this problem has to add a lot of fractions before he can formulate and check his conjectures. Each of the exercises is related to the other because an error will destroy the pattern. This mode of generating exercises also provides a challenge for the more able child, who, being faster in obtaining the solution, can spend more time trying to conceptualize the reasons.

In the example given above, one can go on and investigate the series 1/2 × 4 + 1/4 × 6 + 1/6 × 8 + . . . + 1/28 × 30, and other similar ones. The main point is that such inquiry problems lead to generalizations. If they do not, they provide no goal and the child will see them merely as isolated facts. In trying to relate one series to another, element by element, the child obtains practice in subtraction, multiplication, or, as in the last example, division by an integer, and will eventually come to the correct generalization. But it is extremely important for the teacher to ascertain that every child who is exposed to such an approach knows how to start; otherwise, the experience may become frustrating and lead to rejection and anxiety instead of enjoyment.

While inquiry as a mode of learning new material is now a fairly accepted approach and there are curricula that use it as the basic mode for introducing new material, very little has been done to use this mode for drill and practice. However, the use of inquiry for this purpose is even more important than it is for the learning of new material. When a child is exposed to new material, even though it be through an expository method, his curiosity is aroused because the material is new. In the drill and practice stage, the novelty isn't there any more, and (as said before) the attack on isolated points through sets of exercises related only to rules does not provide enough incentive to sustain his interest.

Incidentally, a valuable source of practice through inquiry lies in the investigation of fractions signified by a point but written in bases other than 10 (for instance, 1/9 = .01 in base three, 1/3 = .010101 . . . [or $.\dot{0}\dot{1}$] in base two), an area overlooked by most textbooks. Finding what common fractions will produce finite decimals when written as decimals, finding whether fractions in the form 1/2 + 1/3 + . . . + 1/*n* ever add to an integer, or finding how many ways 1/2, 1/3, 1/4, etc., can be written as a sum of two unit fractions (fractions with the numerator 1) are further examples of useful inquiry problems in fractions.

In each of these cases, the child gets a great deal of practice while he is investigating successive stages; however, for him there is a goal, an aim, a search for the unknown way beyond the practice.

A similar approach can be taken in algebraic exercises. Children will draw graphical representations of linear or quadratic equations and inequalities with more ardor and less error if they expect that the whole set of graphs will eventually lead to an integrated and meaningful configuration. Exercises in the division of algebraic expressions will have more appeal to them if they are investigating mappings of the form $x \longrightarrow ax + b/cx + d$ through a repetitive process that will eventually generate a finite mathematical group. Computations such as $a+1/b+1/c+1/d$ provide a strong incentive if the child can see a use for them in obtaining consecutive approximations.

The main issues involved in this approach to mathematics learning are:
1. The problems offer an intellectual goal over and above practice in the application of rules.
2. The goal is meaningful to the child because it is related to the conceptual structure he has built up before.
3. To reach the goal, the child has to generate a large number of examples (exercises) in attempting to abstract from them a unifying idea that is related to the attainment of the goal.
4. Each child has the means to generate the examples and test the relations between his findings and the goal.
5. Some of the more able children will have the ability to abstract from the accumulated exercises the principle that leads directly to the attainment of the goal.
But note that care should be taken to generate tasks that will provide practice in *all* areas covered by the unit of studies.

Inquiry problems of the nature described can serve as incentives for practice and drill, even among very young children. We have found that children at the end of grade 1 will do a lot of addition in trying to establish the number of ways a natural number can be written as a sum of consecutive natural numbers (that is, of natural numbers that come one after the other).

We have also found that such tasks provide an incentive for the less able student, provided he possesses the means to start the inquiry, generate the exercises, and start solving them.

Nevertheless, there is one basic requirement in using this method: the student has to have some intellectual curiosity. Sadly enough, by the time some children reach the upper grades they have already lost it. An important part of our task as teachers, therefore, is to keep this curiosity alive.

AU-DESSUS DU NATIONALISME

Gérard Gilbert et Dormer Ellis/OISE

Le développement de la compréhension internationale: un objectif accessible et fascinant pour les éducateurs franco-ontariens

Vinh Bang, professeur vietnamien en Suisse, s'adresse en français à des éducateurs torontois.

Gérard Gilbert, professeur franco-ontarien, a donné des cours de recyclage à des instituteurs du Togo, du Congo, et du Centre-Afrique.

La population mondiale augmente rapidement. Les nations se côtoient de plus en plus. Car les réseaux de communications qui encerclent le globe ne cessent de se multiplier. Il importe donc d'ouvrir l'esprit des jeunes à la grande diversité des cultures humaines. Et que le respect interracial, si naturel dans le bas âge, se maintienne et fleurisse ultérieurement en amour concret. Chez tous les enfants de la terre.

Nos écoles bilingues seraient-elles avantagées en ce qui a trait au développement de l'esprit supranational?

Issu d'une famille française, le Franco-Ontarien entre très tôt en contact avec une autre grande culture — celle de la majorité au Canada et en Amérique du Nord. Aussi longtemps que sa scolarité française ne durait que huit ou dix ans, il pouvait avoir l'impression de vivre sur une île étrangère dans une grande mer anglaise. Il a pu développer alors un sentiment d'infériorité à cause de son idiome maternel isolateur. Car en Ontario, la langue de travail est l'anglais, sauf dans certaines petites municipalités ou centres ruraux. Jusqu'à tout récemment les études secondaires et universitaires se faisaient presque exclusivement en anglais.

Mais avec l'avènement des écoles secondaires de langue française, ce sentiment s'estompe peu à peu. Quatre et parfois huit années de culture supplémentaire en français lui ouvrent de nouveaux horizons sur la francophonie mondiale. Et les éducateurs acceptent leur lourde responsabilité: celle de développer la fierté de l'ascendance et de pourvoir leurs élèves de l'indispensable moyen de communication que constitue le français international.

Sachant fort bien que la connaissance de l'anglais a tendance, en général, à primer en qualité sur la connaissance du français, nos enseignants ont recours à divers moyens particuliers: *a*) leur perfectionnement personnel par des cours spécialisés, la compétence dans la matière elle-même devant avoir la préséance sur les méthodologies; *b*) les séjours en pays de langue française et l'échange de personnel avec ces pays, y compris le Québec; *c*) le jumelage entre écoles françaises de par le monde, ce qui entraîne la correspondance écrite et sonore laquelle peut valoir maintes leçons de français pour nos Ontariens, tout en les renseignant sur des sociétés humaines toujours fascinantes par quelques aspects; *d*) l'utilisation des moyens de diffusion de masse qui font contrepoids à l'ambiance anglicisante et nourrissent l'âme propre du Canadien d'expression française: la télé, la radio, le cinéma, la presse écrite, les disques et bandes magnétiques; e) la mise sur pied de bibliothèques scolaires imposantes par leurs ouvrages français.

Ouvert à une première mentalité différente de la sienne — la mentalité anglo-américaine — qu'il estime à bon droit, le Franco-Ontarien qui a réussi à équilibrer son bilinguisme se sent déjà à l'aise dans tous les pays d'expression française ou anglaise. Cela suffit parfois à le pousser aux voyages qui, sauf pour les toqués, élargissent l'esprit et le coeur, développent la compréhension internationale.

Celui qui a pu conserver, envers et contre tout, l'amour de sa culture et acquérir la maîtrise du français authentique, ne sera-t-il pas heureux de visiter et d'aider les nombreux pays français de l'Afrique, de l'Asie, du Proche-Orient, de l'Europe, des Antilles. Et grâce à son maniement de l'anglais, le francophone ontarien se sent à l'aise dans d'autres vastes parties du monde qui peuvent l'attirer et dont il peut mieux comprendre les habitants: le Canada anglais, les Etats-Unis, les pays du Commonwealth. (Les vrais bilingues ou polyglottes seraient-ils les meilleurs agents d'entente internationale, les éléments les plus pacifiques, en général? Bon sujet de thèse.)

Sans déplacements corporels, ce type de bilingue à l'esprit ouvert auquel nous faisons allusion trouve quotidiennement autour de lui cent et un moyens de connaître et d'aimer les autres peuples: lectures, cinéma, peinture, radio, télévision, clubs, etc. Tandis que la plupart des gens n'ont qu'une seule voie de départ pour faire cela, le bilingue dispose sans cesse d'une double avenue d'accès sur les réalités sociales du monde.

Cette espèce de gymnastique intellectuelle et cordiale portant sur deux des plus grandes civilisations de la terre, prédispose, semble-t-il, aux contacts nouveaux, provoque une faim d'humanité. Cela explique peut-être la tendance du Franco-Ontarien à regarder au-dessus des chicanes provinciales ou nationales pour s'accommoder des situations inéluctables que posent la géographie, le commerce, et la technologie, préférant aux complots vindicatifs la joie de vivre. Et de vivre non seulement dans l'ambiance canadienne-française, mais encore, quand il le faut, n'importe où dans ce *global village* qu'est le monde actuel, dans tous les milieux où la nature et les gens lui apportent quelque chose et ont besoin de lui.

La solidarité valable, aujourd'hui, ne s'arrête plus aux frontières.

Teaching Aids from the Community

Bell Canada

Readers are reminded that, because of the high cost involved in the preparation of materials reviewed, requests should be made only when appropriate use is assured.

Publications
The following publications are available, without charge, from *local business offices of Bell Canada*, or in Toronto, from *the Public Relations Department, 929-6805.*

Alexander Graham Bell
A 15-page illustrated booklet telling the story of Bell's life and his inventions. His work with the deaf is shown as a contributing factor in his invention of the telephone.

The Wonder of Your Telephone
An illustrated booklet that traces communications in Canada from the first telephone to radio-relay and satellite communications systems.

The Telephone Story
A 4-page black-and-white brochure that follows, in word and picture, the development of the telephone from the 'gallows frame telephone' of 1875 to the 'picturephone' of the future.

Special Aids
Cardiac — a cardboard illustrative aid to computation
An educational aid produced by Bell Telephone Laboratories to illustrate the operation of a computer, *Cardiac* is of practical assistance in understanding computers and computer programming. *Cardiac* is accompanied by assembly instructions and a manual that combines directions for its use with information on the use and operation of computers.

Teachers in Toronto can get further information about this aid by calling Bell Canada Public Relations at 929-2846. Those teachers outside Toronto should call (416) 929-2846, collect.

Telezonia Kit
A teaching aid designed to instruct children in grades 3, 4, and 5 in the proper use of the telephone. The kit contains a 16 mm. color film, 'We Learn About the Telephone,' four 35 mm. color filmstrips, two telephones, two telephone directories, instruction guides for teachers, and textbooks for pupils. Arrangements for borrowing a *Telezonia Kit* may be made by telephoning any Bell Canada business office.

Films
With the exception of *Her City*, all the films listed are 16 mm. and in color. Those available in French as well as in English are marked with an asterisk. Arrangements to borrow are made through the Toronto office. Please call collect (416) 929-6805. Requests for films should indicate both first and second choice of title and should be made as long as possible in advance of the date of showing. Films should be returned promptly and should be accompanied by a report on the number of showings and the attendance.

Beyond All Barriers
(28 minutes) Many parts of the world are visited in this film, which traces the role of communication in the development of civilization.

Communication
(20 minutes) An abstract presentation that reviews communications through the ages and looks at communications media in Canada today. Content is equally balanced between French and English.

*A Nation in Touch**
(26 minutes) The construction and role of the world's longest microwave system are reviewed in this film, which examines the microwave radio-relay system in Canada.

Dew Line Story
(28 minutes) A record of the erection, by the Bell System, of the Distant Early Warning Line — the series of radar stations that carry our continental defence beyond the Arctic Circle.

*Here Is Tomorrow**
(28 minutes) The story of Alexander Graham Bell, filmed in the actual setting of his work in North America.

*Lasers Unlimited**
(10 minutes) This film explores the promise of the laser and its application in science, industry, and medicine.

Incredible Machine
(16 minutes) Sequences of computer-generated movies, photographs, music, and speech combine to demonstrate how Bell Laboratories use computers in communications research.

Gateways to the Mind
(59 minutes) A scientific outline of what happens when man sees, hears, tastes, smells, and feels — the response of the brain to sensory stimulation.

Hemo the Magnificent
(59 minutes) The human circulatory system and the function of the heart are explained by animation and documentary.

Our Mr. Sun
(59 minutes) A dramatic look at man's knowledge of the sun — its effect on all forms of life, phenomena relating to it, thermonuclear reaction, photosynthesis in plants, and the solar battery.

The Alphabet Conspiracy
(59 minutes) This film highlights the history of language and its relationship to other fields of study through a fanciful story in which a plot to destroy the alphabet is thwarted.

Bell Solar Battery
(12 minutes) This film shows how man's dream of converting the sun's rays into usable power approaches realization with the development of the 'solar battery,' whose manufacture and operation are shown in a laboratory sequence.

The Thread of Life
(59 minutes) A look at genetics that examines the factors that determine the physical characteristics of men, animals, and plants.

The Strange Case of the Cosmic Rays
(59 minutes) Man's half-century-long study of cosmic rays is reviewed in this film of a journey into outer space. Combines live action, animation, and still photography.

*Fire: Cause for Alarm**
(11 minutes) This film examines the causes of fires and shows how their devastation of human life and property can be controlled.

*Anatomy of an Accident**
(27 minutes) A safe driving film that shows how a representative accident happened and draws attention to unsafe driving habits, their results, and their correction.

About Time
(59 minutes) This film combines documentary and animation in an examination of time measurement — the evolution of the calendar, the development of clocks, the built-in timing mechanisms of plants and animals, and precision timing.

The Unchained Goddess
(59 minutes) The many aspects of weather are investigated by scientists in this film, which features 'Meteora, goddess of weather' and her 'court.'

A Sense of Hearing
(10 minutes) Photography, music, sound, and animation combine in this portrayal of man's hearing process.

The Restless Sea
(58 minutes) A wide-ranging report on the sea that follows oceanographers as they probe the mysteries of the underwater world.

*Genesis of the Transistor**
(15 minutes) The invention of the transistor shown as the culmination of experimental processes.

*Horizons Beyond**
(12 minutes) A story of scientists at work on the horizons of human knowledge and how their findings give birth to far-reaching developments.

*The Speech Chain**
(19 minutes) Pictures of the human vocal tract and of the vocal chord in action are shown in this film, which has application for the secondary school science program.

Science Behind Speech
(8 minutes) A review of the dependence of improved telephone transmission on a better understanding of the sound characteristics of the voice.

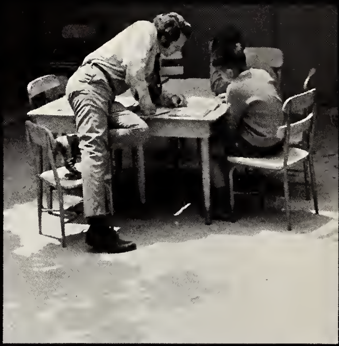
*Your Voice and the Telephone**
(7 minutes) A simple explanation of the scientific principles governing the operation of the telephone.

*Her City**
(19 minutes — black-and-white) A documentary on today's telephone operator and the significance of her role in the community.

*The Voice Beneath the Sea**
(27 minutes) The construction of the first physical voice link between North America and Europe, showing cable-laying operations and the manufacture of equipment.

Operator
(14 minutes) An on-duty demonstration and an off-duty discussion of the role of the telephone operator.

*Sky Watch on 55**
(33 minutes) A dramatic record of the building of the detection and warning system along the 55th parallel.



Profile of a School 7

University Elementary School at UCLA

University Elementary School, on the campus of the University of California in Los Angeles, has earned a worldwide reputation for its studies in elementary school teaching. The director of the school, Dr. John Goodlad, comes from British Columbia; the principal, Dr. Madeline Hunter, comes from Saskatchewan.

The school, which has been in operation for ten years, is completely nongraded and takes in children from three to twelve years of age. Although it is organized into four phases — the early childhood phase, and the lower, middle, and upper elementary phases — the child's progress through the phases is not based on his age, the number of years he has spent in school, or the scores he has obtained on standardized tests. Instead, he moves on as the school's objectives are met.

Objectives in the early childhood phase are the development of autonomy and of the ability to work and play productively with peers, as well as with materials and ideas, and to relate appropriately to teachers. Lower elementary objectives are built around the acquisition of basic reading, writing, mathematical, and communications skills. Middle and upper elementary objectives are centered on the development of self-evaluation skills, effective learning strategies, self-propulsion in learning, and a zest for it. Both academic subjects and the arts are taught in all four phases.

The 460-odd children enrolled in the school come from throughout the Los Angeles area and represent a socioeconomic cross-section of the community. Children with handicaps are also enrolled, provided they are not totally blind or deaf, or confined to a wheelchair. With rare exceptions, new pupils are randomly selected from a lengthy waiting list of about 4,000 applicants.

Another important aspect of the University Elementary School program is its use of team teaching. Each child is assigned to the team that seems best suited to his individual needs in terms of teaching style and peer-group environment. Because the children's ages overlap, alternatives of teacher and peer-group assignment are always available.

Planning objectives, instruction, and evaluation of the child's achievement of objectives are always the result of cooperative effort within the team. Before determining the further assignment of children to particular teachers or instructional groups within the team, the following considerations are taken into account: Which teacher is likely to be most successful with this child? In what kind of group will this child learn most? At what level of difficulty in each subject should this child be working? Decisions concerning the teacher and peer-group composition appropriate for the child take priority. The child's previous academic achievement is used solely to assess his educational needs so that he will be in a cluster of children with similar needs.

No group or teacher assignments are permanent; they continue only as long as the team members judge them to be efficient and productive. In general, though, placements last a year. Most children spend two years in each of the four phases, but the composition of the peer groups changes each year as some children move out of the phase and others enter it.

Instruction is further individualized by making adjustments along three dimensions: what is to be learned, what the learner will do to accomplish learning, and what the teacher can do to make the child's learning more efficient and more likely to be successful. If learning is not taking place, corrective procedures are adopted without delay.

While each child is encouraged to learn independently and to decide for himself which objectives to pursue and which routes to follow to achieve his ends, through constant evaluation of the learning process, his learning is monitored and guided at every stage along the way.